

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

January 22, 1839.—The Rev. F. W. Hope in the chair.

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Professor Owen concluded his paper entitled, "Outlines of a Classification of the Marsupialia." "The rich stores of the Menagerie and Museum of the Zoological Society," observes Mr. Owen; "having afforded me frequent opportunities of examining the anatomy of various and rare species of the Marsupial order; the endeavour to express in general propositions the more important facts relative to their organization; to state in which particulars so many agreed or differed; has naturally compelled me to acquire certain ideas respecting their Zoological distribution."

In the first part of the paper, Professor Owen defines the general characters of the *Marsupialia*; he then proceeds to consider their mutual affinities; and, as closely connected with this subject, commences with some observations on their size, their geographical distribution, and their habits.

The carnivorous Marsupial animals belonging to the genera *Thylacinus* and *Dasyurus* are compared to the *Carnivora* in the placental series; and the Bandicoots (*Perameles*), and Myrmecobians are represented as typifying, or playing corresponding parts, with those allotted to the placental *Insectivora*. Those Marsupials which have an omnivorous diet, live in trees, are provided with a prehensile tail, and have a thumb on the hinder extremities, are said to typify the *Quadrumania*, and the tailless Koala is compared to the arboreal Sun-Bears of the Indian Archipelago.

"Another genus of *Marsupialia*, the Wombat," says Mr. Owen, "presents the dentition which characterizes the placental *Rodentia*; and the Petaurists, like the Flying Squirrels, have a parachute formed by broad duplications of the skin extending laterally between the fore and hind legs.

"The Kangaroos are the true herbivorous *Marsupialia*, and many interesting physiological conditions present themselves to the mind in contemplating the singular construction and proportions of these animals. It would appear that the peculiarities of their gestation rendered indispensably necessary the possession of a certain prehen-

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sile faculty of the anterior extremities, with a free movement of the digits and a rotatory power of the fore-arm, in relation to the manipulations of the pouch and of the embryo developed therein. At the same time a herbivorous quadruped must possess great powers of locomotion in order to pass from pasture to pasture and to avoid its enemies by flight. These powers, as is well known, are secured to the herbivorous species of the placental *Mammalia*, by an ungulate structure of four pretty equally developed members. Such a structure, however, would have been incompatible with the procreative æconomy of the Kangaroo. It is therefore organized for rapid locomotion by an excessive development of the hinder extremities; and these alone serve as the instruments of flight, which is performed by a succession of extensive bounds. The tail also is of great power and length, and in the stationary position, the body is supported erect on the tripod formed by the tail and hind legs; while in easy progression the tail serves as a crutch upon which and the fore feet the body is sustained while the hind legs are swung forwards.

“As the Australasian continent, the great metropolis of the Marsupial quadrupeds, still remains but very partially explored; and as new species and even genera of Marsupials continue at each expedition to reward the researches of the scientific traveller; and as moreover the recovery of two lost but distinct genera from the ruins of a former world makes it reasonable to suppose that other types of Marsupials remain still hidden in the crust of the earth; it can hardly be expected that the zoologist should be able to arrange in a natural series, with easy transitions according to the order of their affinities, the few and diversified forms of this implacental subclass which are at present known. The greatest number of correspondencies, as it appears to me, will be expressed by taking the modifications of the digestive system as the guide to the formation of the primary groups of the *Marsupialia*.

“The continent, however, in which the Marsupials ‘most do congregate’ is characterized by the paucity of organized matter upon its surface, and few of them, consequently, are nourished by a very well-defined diet. No large carnivorous quadruped could in fact have existed in the wilds of Australia prior to the introduction of civilized man and his attendant herds: and we find, in fact, that the native genera which are the most decidedly carnivorous, do not include species larger than the dog: we can only reckon among these strictly carnivorous species the Thylacines and the Dasyures; and, on the other hand, not more than two or three Marsupial

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Tribe I. *SARCOPHAGA*.

The genera in this tribe are the most decidedly carnivorous of all the *Marsupialia*, and are characterized by an important anatomical condition, viz. the absence of an *intestinum cæcum*.

Genus 1. *Thylacinus*.

Incisors $\frac{4-4}{3-3}$; canines $\frac{1-1}{1-1}$; præmolares $\frac{3-3}{3-3}$; molares $\frac{4-4}{4-4} = 46$.

The incisors are of equal length, and regularly arranged in the segment of a circle with an interspace in the middle of the series of both jaws. The external incisor on each side is the strongest.

The laniary or canine teeth are long, strong, curved, and pointed, like those of the dog tribe.

The spurious molares are of a simple, blunt, conical form, each with two roots; the last with a small additional posterior cusp. The true molares in the upper jaw are unequally triangular with three tubercles. Those in the lower jaw are compressed, tricuspidate, the middle cusp being the longest, especially in the two last molares, which resemble closely the sectorial teeth (*dens carnassiers*) of the Dog and Cat. The fore feet are 5-digitate, the hind feet 4-digitate.

On the fore foot the middle digit is the longest, the internal one or *pollex* the shortest, but the difference is slight. On the hind foot the two middle toes are of nearly equal length and longer than the two lateral toes, which are equal. All the toes are armed with strong, blunt, and almost straight claws. The only known species of this genus, the Thylacine (*Thylacinus Harrisii*, *Didelphys Cynocephalus*, Harris), is a native of Van Diemen's Land, and is called by the colonists the 'Hyæna.'

Genus *Dasyurus*.

Incisors $\frac{4-4}{3-3}$; canines $\frac{1-1}{1-1}$; præmolares $\frac{2-2}{2-2}$; molares $\frac{4-4}{4-4} = 42$.

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The eight incisors of the upper jaw are of the same length and

simple structure, and are arranged in a regular semicircle without any middle interval. The six incisors of the lower jaw are similarly arranged but have thicker crowns than the upper ones; the canines present the same or even a greater relative development than in the *Thylacine*. In an extinct species of *Dasyurus* they present the same form and relative properties as in the *Leopard*. The spurious molares have two fangs and a pointed compressed triangular crown with a rudimental tubercle at the anterior and posterior part of its base. The grinding surface of the true molares in the upper jaw is triangular; the first presents four sharp cusps, the second and third each five, the fourth, which is the smallest, only three. In the lower jaw the last molar is nearly of equal size with the penultimate one, and is bristled with four cusps, the external one being the longest; the second and third molares have five cusps, three on the inner and two on the outer side; the first molar has four cusps: these are all sharply pointed in the young animal, in which the tubercle of the posterior molar of the lower jaw is divided into two small cusps.

The carnivorous character of the previous dentition is most strongly marked in the *Ursine Dasyure*, or Devil of the Tasmanian colonists, the largest existing species of the genus, and a most pestilent animal in the poultry yard or larder.

Genus *Phascogale*.

Incisors $\frac{4-4}{3-3}$; canines $\frac{1-1}{1-1}$; præmolares $\frac{3-3}{3-3}$; molares $\frac{4-4}{4-4} = 46$.

In the present dental formula may be discerned a step in the transition from the *Dasyures* to the *Opossums*, not only in the increased number of spurious molares, but also in shape and proportions of the incisors. In the upper jaw the two middle incisors are longer than the rest, and separated from them by a brief interval; they are more curved and project more forward. The three lateral incisors diminish in size to the outermost. The middle incisors of the lower jaw also exceed the lateral ones in size, and project beyond them but not in the same degree, nor are they separated from them by an interval as in the upper jaw. The canines are relatively smaller than in the *Dasyures*. The spurious molares present a similar form, but the third is much smaller and simpler than the two preceding ones. The true molares resemble in their structure those of the *Dasyures*. The general character of the dentition of these small *Marsupials* approximates to the insectivorous type in the *Shrew*, *Hedgehog*, &c., among the placental

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The carnivorous character of the previous dentition is most strongly marked in the *Ursine Dasyure*, or Devil of the Tasmanian colonists, the largest existing species of the genus, and a most pestilent animal in the poultry yard or larder.

Genus *Phascogale*.

Incisors $\frac{4-4}{3-3}$; canines $\frac{1-1}{1-1}$; præmolares $\frac{3-3}{3-3}$; molares $\frac{4-4}{4-4} = 46$.

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Dasypus is further carried out in the small size of the molares, their separation from each other by slight interspaces, and their implantation in sockets which are not formed by a well-developed alveolar ridge. The molares, however, present a distinct tuberculate structure; and both the true and false ones possess two separate fangs as in their Marsupial congeners: they are, however, the least produced of any Marsupials; only the triturating tubercles appearing above the gum.

The false molares present the usual compressed triangular form, with the apex slightly recurved, and the base more or less obscurely notched before and behind. The canines are very little longer than the false molares; the incisors are minute, slightly compressed and pointed; they are separated from each other and the canines by wide intervals.

The Myrmecobians are insectivorous, and shelter themselves in the hollows of trees, frequenting most, it is said, those situations where the Port Jackson Willow abounds. In the structure and proportions of the hinder feet, *Myrmecobius* resembles the Dasyurine family; and in the slightly developed canines, the smooth external surface of the skull, the breadth between the zygomata, and the absence of the interparietal ridges, as well as in the general external form and bushy tail, it offers an especial approximation to the genus *Phascogale*.

Intermediate however to *Myrmecobius* and *Phascogale* would seem to be the station held by the interesting extinct genera above alluded to. In *Phascolotherium* the affinity is manifested in the simple form, small size, and straggling disposition of the incisors and canines: in the other genus, *Thylacotherium*, it is displayed in the size and number of its molares.

This, one of the most ancient mammiferous genera hitherto discovered, presents eleven molares on each side of the lower jaw, which resemble in structure and close arrangement those of *Phascogale* and *Didelphis*, while they are intermediate in their proportional size to these and *Myrmecobius*. The exact condition of the incisors and canines of the *Thylacotherium* has not yet been displayed in the fossil jaws which have been discovered.

SALTATORIA.

Genus *Perameles* (Bandicoots).

Incisors $\frac{5-5}{3-3}$; canines $\frac{1-1}{1-1}$; præmolares $\frac{3-3}{3-3}$; molares $\frac{4-4}{4-4} : = 48$.

This dental formula characterizes a number of Rat-like *Insectivora* commonly known in Australia by the name of Bandicoots; the hind

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legs are longer and stronger than the fore, and exhibit in a well-marked manner the feeble and slender condition of the second and third digits counting from the inside, and the sudden increase in length and strength of the third and fourth digits, which are chiefly subservient to locomotion: the mode of progression in the Bandicoots is by bounds; the hind and fore feet being moved alternately as in the Hare and Rabbit; and the crupper raised higher than the fore quarter. The teeth which offer the greatest range of variation in the present genus are the external or posterior incisors and the canines: the molares, also, which originally are quinque-cuspidate, have their points worn away, and present a smooth and oblique grinding surface in some species sooner than in others.

The Bandicoots which approach nearest to the *Myrmecobius* in the condition of the incisive and canine teeth are the *Perameles obesula* and *P. radiata*. There is a slight interval between the first and second incisor, and the outer or fifth incisor of the upper jaw is separated from the rest by an interspace equal to twice its own breadth, and moreover presents the triangular, pointed, canine-like crown which characterizes all the incisors of *Myrmecobius*; but the four anterior incisors are closely arranged together and have compressed, quadrate, true incisive crowns. From these incisors the canine is very remote, the interspace being equally divided by the fifth pointed incisor, which the canine very slightly exceeds in size. In *Peram. nasuta* the incisor presents the same general condition, but the canines are relatively larger.

The marsupial pouch in the Bandicoots, at least in the full-grown females of *Per. nasuta*, *Per. obesula*, and *Per. lagotis*, has its orifice directed downwards or towards the cloaca, contrariwise to its ordinary disposition in the Marsupials: this direction evidently relates to the position of the trunk when supported on the short fore and long hind legs. In the stomach and intestines of a *Perameles obesula*, I found only the remains of insects; and in the examination of the alimentary canal of a *Per. nasuta*, Dr. Grant obtained the same results.

Genus *Charopus*.

The singular animal on which this genus is founded is briefly noticed and figured in Major Mitchell's Australia, (vol. ii. pl. 38. p. 131.) and the individual described is preserved in the Colonial Museum, at Sydney, N. S. Wales, (No. 35. of Mr. George Bennett's Catalogue). It would appear that the two outer toes of the fore-foot, which are always very small in the true Bandicoots, are en-

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irely deficient in the *Charopus*, unless some rudiments should exist beneath the skin; at all events only two toes are apparent externally, but they are so armed and developed as to be serviceable for burrowing or progression. The inner toe is wanting on the hind foot. Dental formula:

Incisors $\frac{4-4}{3-3}$; canines $\frac{1-1}{1-1}$; præmolares $\frac{3-3}{3-3}$; molares $\frac{4-4}{4-4}$: = 46.

All the teeth are of small size; the canines resemble the spurious molares in size and shape, and these are separated at intervals as in *Myrmecobius*. The marsupium opens downwards in the *Charopus*, as in the true Bandicoots. The species described has no tail. The genus would seem by its dentition to rank between *Myrmecobius* and *Perameles*. Its digital characters are anomalous and unique among the *Marsupialia*.

SCANSORIA.

Didelphidæ, Opossums.

These Marsupials are now exclusively confined to the American Continents, although the fossil remains of a small species attest the former existence of the genus *Didelphis* in Europe contemporaneously with the Palæothere, Anoplothere, and other extinct Pachyderms whose fossil remains characterize the Eocene strata of the Paris Basin. The dental formula of the genus *Didelphis* is,

Incisors $\frac{5-5}{4-4}$; canines $\frac{1-1}{1-1}$; præmolares $\frac{3-3}{3-3}$; molares $\frac{4-4}{4-4}$: = 50.

The Opossums resemble in their dentition the Bandicoots more than the Dasyures, except in the structure of the molares.

The two middle incisors of the upper jaw are more produced than the others, from which they are separated by a short interspace. The canines are well developed, the upper being always stronger than the lower. The false molares are simply conical; the true ones beset with sharp points, which wear down into tubercles as the animal advances in age.

In the type of the subgenus *Cheironectes*, besides being web-footed, the anterior extremities present an unusual development of the pisiform bone, which supports a fold of the skin, like a sixth digit; it has indeed been described, as such, by M. Temminck; this process has not of course any nail. The dentition of the Yapock resembles that of the ordinary *Didelphis*. All the Opossums have the inner digit of the hind foot converted by its position and development into a thumb, but without a claw. The hinder hand is associated in almost all the species with a scaly prehensile tail.

In some of the smaller Opossums the subabdominal tegumentary folds merely serve to conceal the nipples, and are not developed into

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The two middle incisors of the upper jaw are more produced than the others, from which they are separated by a short interspace. The canines are well developed, the upper being always stronger than the lower. The false molares are simply conical; the true ones beset with sharp points, which wear down into tubercles as the animal advances in age.

In the type of the subgenus *Cheironectes*, besides being web-footed, the anterior extremities present an unusual development of the pisiform bone, which supports a fold of the skin, like a sixth digit; it has indeed been described, as such, by M. Temminck; this process has not of course any nail. The dentition of the Yapock resembles that of the ordinary *Didelphis*. All the Opossums have the inner digit of the hind foot converted by its position and development into a thumb, but without a claw. The hinder hand is associated in almost all the species with a scaly prehensile tail.

In some of the smaller Opossums the subabdominal tegumentary folds merely serve to conceal the nipples, and are not developed into

irely deficient in the *Charopus*, unless some rudiments should exist beneath the skin; at all events only two toes are apparent externally, but they are so armed and developed as to be serviceable for burrowing or progression. The inner toe is wanting on the hind foot. Dental formula:

Incisors $\frac{4-4}{3-3}$; canines $\frac{1-1}{1-1}$; præmolares $\frac{3-3}{3-3}$; molares $\frac{4-4}{4-4}$: = 46.

All the teeth are of small size; the canines resemble the spurious molares in size and shape, and these are separated at intervals as in *Myrmecobius*. The marsupium opens downwards in the *Charopus*, as in the true Bandicoots. The species described has no tail. The genus would seem by its dentition to rank between *Myrmecobius* and *Perameles*. Its digital characters are anomalous and unique among the *Marsupialia*.

SCANSORIA.

Didelphidæ, Opossums.

These Marsupials are now exclusively confined to the American Continents, although the fossil remains of a small species attest the former existence of the genus *Didelphis* in Europe contemporaneously with the Palæothere, Anoplothere, and other extinct Pachyderms whose fossil remains characterize the Eocene strata of the Paris Basin. The dental formula of the genus *Didelphis* is,

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a pouch ; the young in these adhere to the mother by entwining their little prehensile tails around hers, and cling to the fur of the back ; hence the term *dorsigera* applied to one of these Opossums*.

Tribe III. *CARPOPHAGA*.

Stomach simple ; cæcum very long.

In this family, the teeth, especially those at the anterior part of the mouth, present considerable deviations from the previously described formulæ ; the chief of which is a predominating size of the two anterior incisors, both in the upper and lower jaw. Hitherto we have seen that the dentition in every genus has participated more or less of a carnivorous character ; henceforth it will manifest a tendency to the Rodent type.

The Phalangers, so called from the phalanges of the second and third digits of the hinder extremities being inclosed in a common sheath of integument, have the innermost digit modified, to answer the purposes of a thumb ; and the hinder hand being associated in many of the species with a prehensile tail, they evidently, of all *Frugivora*, come nearest the arboreal species of the preceding section. In a system framed on locomotive characters they would rank in the same section with the Opossums. We have seen, however, that they differ from those Entomophagous Marsupials greatly in the condition of the intestinal tube. Let us examine to what extent the dental characters deviate from those of the Opossums.

In the skull of a *Phalangista Cookii*, now before me, there are both in the upper and lower jaw four true molares on each side, each beset with four three-sided pyramidal sharp-pointed cusps ; thus these essential and most constant teeth correspond in number with those of the Opossum : but in the upper jaw they differ in the absence of the internal cusp, which gives a triangular figure to the grinding surface of the molares in the Opossum ; and the anterior single cusp is wanting in the true molares of the lower jaw.

Anterior to the grinders in the Phalanger, there are two spurious molares, of similar shape and proportions to those in the Opossum ; then a third spurious molar, too small to be of any functional im-

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The canine tooth but slightly exceeds in size the above false molar, and consequently here occurs the first great difference between the Phalangers and Opossums; it is however, only a difference in degree of development; and in the Ursine and other Phalangers, as well as in the Petaurists, the corresponding tooth presents more of the proportions and form of a true canine.

The incisors, which we have seen to be most variable in number in the carnivorous section, are here three instead of five on each side, in the upper jaw, but their size, especially that of the first, compensates for their fewness.

In the lower jaw, there is the same number of true molares and of functional false molares, which form a continuous and tolerably equable series, as in the Opossums, on each side; then two very minute and rudimental teeth on each side represent the small spurious molar, and small canine of the upper jaw; and anterior to these, there is one very small and one very large and procumbent incisor on each side.

The constant teeth in this group are the $\frac{4-4}{4-4}$ true molares, and the $\frac{3-3}{1-1}$ incisors. The canines $\frac{1-1}{1-1}$ are constant in regard to their presence, but variable in size; they are always minute in the lower jaw. With respect to the spurious molares, $\frac{1-1}{1-1}$, they are always in contact with the true grinders, and their crowns reach to the same grinding level; sometimes a second spurious molar is similarly developed as in the *Phal. Cookii*, and as in all the flying Phalangers, or Petaurists, but it is commonly absent or replaced by a very minute tooth, shaped like a canine: so that between the posterior spurious grinder and the incisors we may find three teeth, of which the posterior is the largest, as in *Phal. Cookii*, or the smallest, as in *Phal. cavifrons*; or there may be only two teeth, as in *Phal. ursina* and *Phal. vulpina*, and the species, whatever that may be, which Fr. Cuvier has selected as the type of the dentition of this Genus.

In the lower jaw similar varieties occur in these small and unimportant teeth; *e. g.* there may be between the procumbent incisors and the posterior false molar, either four teeth, as in *Phal. Cookii*; or three, as in *Phal. cavifrons*; or two, as in *Phal. ursina*, *Phal. maculata*, *Phal. chrysorrhoea*; or lastly, one, as in *Phal. vulpina*, and *Phal. fuliginosa*.

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Genus *Petaurus*.

There are many species of Marsupials limited to Australia, and closely resembling or identical with the true Phalangiers in their dental characters and the structure of the feet. I allude to the Petaurists or Flying Opossums; these, however, present an external character so easily recognizable, and influencing so materially the locomotive faculties, as to claim for it more consideration than the modifications of the digits or spurious molares, which we have just been considering in the *Phalangista*. A fold of the skin is extended on each side of the body between the fore and hind legs, which, when outstretched, forms a lateral wing or parachute, but which, when the legs are in the position for ordinary support or progression, is drawn close to the side of the animal by the elasticity of the subcutaneous cellular membrane, and then forms a mere tegumentary ridge. These delicate and beautiful Marsupials have been separated generically from the other Marsupials under the name of *Petaurus**: they further differ from the Phalangiers in wanting the prehensile character of the tail, which in some species of *Petaurus* has a general clothing of long and soft hairs, whilst in others the hairs are arranged in two lateral series.

Now in the Petaurists there is as little constancy in the exact formula of the dentition as among the Phalangiers. The largest species of *Petaurus*, *Pet. Taguanoides*, e. g., is almost identical in this respect with the *Phalangista Cookii*, which M. Fr. Cuvier has therefore classed with the *Petauri*. Those teeth of *Pet. Taguanoides*, which are sufficiently developed, and so equal in length, as to exercise the function of grinders, or in other words, the functional series of molares, include six teeth on each side of the upper jaw, and five teeth on each side of the lower jaw. The four posterior molares in each row are true, and bear four pyramidal cusps, excepting the last tooth in the upper jaw, which, as in *Phal. Cookii*, has only three cusps. In the upper jaw, the space between the functional false molares and the incisors is occupied by two simple rudimentary teeth, the anterior representing the canine, but being relatively smaller than in *Phal. Cookii*. The crowns of the two anterior incisors are relatively larger. In the lower jaw the sloping alveolar surface between the functional molares and large procumbent incisors is occupied, according to M. Fr. Cuvier, by two rudimentary minute teeth: I have not found any trace of these in the two skulls of *Pet. Taguanoides* examined by me. In *Phal. Cookii* there are three minute

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There are many species of Marsupials limited to Australia, and closely resembling or identical with the true Phalangiers in their dental characters and the structure of the feet. I allude to the Petaurists or Flying Opossums; these, however, present an external character so easily recognizable, and influencing so materially the locomotive faculties, as to claim for it more consideration than the modifications of the digits or spurious molares, which we have just been considering in the *Phalangista*. A fold of the skin is extended on each side of the body between the fore and hind legs, which, when outstretched, forms a lateral wing or parachute, but which, when the legs are in the position for ordinary support or progression, is drawn close to the side of the animal by the elasticity of the subcutaneous cellular membrane, and then forms a mere tegumentary ridge. These delicate and beautiful Marsupials have been separated generically from the other Marsupials under the name of *Petaurus**: they further differ from the Phalangiers in wanting the prehensile character of the tail, which in some species of *Petaurus* has a general clothing of long and soft hairs, whilst in others the hairs are arranged in two lateral series.

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The Pigmy Petaurist differs from the preceding and larger species in having the hairs of the tail distichous or arranged in two lateral series like the barbs of a feather; and in having the spurious molares large and sharply pointed; and the true molares bristled each with four acute cusps. This tendency in the dentition to the insectivorous character, with the modification of the tail, induced M. Desmarest to separate the Pigmy Petaurist from the rest of the species, and constitute a new subgenus under the name of *Acrobata*.

In four adult specimens, and two of which had young in the pouch, I find the following dental formula to be constant;—incisors $\frac{3-3}{1-1}$; canines $\frac{1-1}{1-1}$; præmolares $\frac{3-3}{3-3}$; molares $\frac{3-3}{3-3}$: = 36.

The three quadricuspidate grinders of the upper jaw are preceded by three large spurious molares, each of which has two fangs, and a compressed, triangular, sharp-pointed crown, slightly but progressively increasing in length, as they are placed forwards. An interspace occurs between these and the canine, which is long, slender, sharp-pointed, and recurved. The first incisor is longer than the two be-

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Genus *Phascolarctus*.

The absence of anomalous spurious molares and of inferior canines appears to be constant in the only known species of this genus. The dental formula in three of this species, (*Phasc. fuscus* Desm.,) is: Incisors $\frac{3-3}{1-1}$; canines $\frac{1-1}{0-0}$; præmolares $\frac{1-1}{1-1}$; molares $\frac{4-4}{4-4} = 30$.

The true molares are larger in proportion than in the Phalangiers; each is beset with four three-sided pyramids, the cusps of which wear down in age; the outer series in the upper teeth being the first to give way; those of the lower jaw are narrower than those of the upper. The spurious molares are compressed, and terminate in a cutting edge; in those of the upper jaw there is a small parallel ridge along the inner side of the base. The canines slightly exceed in size the posterior incisors; they terminate in an oblique cutting edge rather than a point, their fang is closed at the extremity; they are situated as in the Phalangiers close to the intermaxillary suture. The lateral incisors of the upper jaw are small and obtuse, the two middle incisors are of twice the size, conical, subcompressed, beveled off obliquely to an anterior cutting edge, but differing essentially from the *dentes scalprarii* of the *Rodentia*, in being closed at the extremity of the fang. The two incisors of the lower jaw resemble those of the upper, but are longer and more compressed: they are also formed by a temporary pulp, and its absorption is accompanied by a closure of the aperture of the pulp cavity, as in the upper incisors. The Koala therefore, in regard to the number, kind, and conformation of its teeth, closely resembles the Phalangiers, with which it agrees in its long cæcum, but the stomach has a cardiac gland as in the Wombat. The extremities of the Koala are organized for prehension; each is terminated by five digits; the hind feet are provided with a large thumb, and have the two contiguous digits enveloped in the same tegumentary fold; the anterior digits are divided into two groups, the thumb and index being opposed to the other three fingers. The fore-paws have a similar structure in some of the small Phalangiers; it is very conspicuous in some of the Petaurists. The Koala, however, differs from the Phalangiers and Petaurists in the extreme shortness of its tail and in its more compact and heavy general form. It is known to feed on the buds and leaves of the trees in which it habitually resides.

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Tribe IV. POEPHAGA.

The present tribe includes the most strictly vegetable feeders; all the species have a complex sacculated stomach and a long simple cæcum.

Guided by the modifications of the teeth we pass from the Koala to the Kangaroo family (*Macropodidae*),—animals of widely different general form. The Potoroos, however, in this group, present absolutely the same dentition as the Koala, some slight modifications in the form of certain teeth excepted. The spurious molares, in their longitudinal extent, compressed form, and cutting edge, would chiefly distinguish the dentition of the Potoroo, but the Koala evidently offers the transitional structure between the Phalangiers and Potoroos in the condition of these teeth, of which one only is retained on each side of each jaw, in both *Phascolarctus* and *Hypsiprymnus*.

The dental formula of the genus *Hypsiprymnus* is: incisors $\frac{3-3}{1-1}$; canines $\frac{1-1}{0-0}$; præmolares $\frac{1-1}{1-1}$; mol. $\frac{4-4}{4-4}$: = 30.

The two anterior incisors are longer and more curved, the lateral incisors relatively smaller than in the Koala. The pulps of the anterior incisors are persistent.

The canines are larger than in the Koala; they always project from the line of the intermaxillary suture; and while the fang is lodged in the maxillary bone, the crown projects almost wholly from the intermaxillary. In the large *Hypsiprymnus ursinus* the canines are relatively smaller than in the other Potoroos, a structure which indicates the transition from the Potoroo to the Kangaroo genus. In the skeleton of this species in the Leyden Museum the canines present a longitudinal groove on the outer side.

The characteristic form of the trenchant spurious molar has just been alluded to; its maximum of development is attained in the arboreal Potoroos of New Guinea (*Hypsiprymnus ursinus*, and *Hyps. dorsocephalus*); in the latter of which its antero-posterior extent nearly equals that of the three succeeding molar teeth.

In all the Potoroos the trenchant spurious molar is sculptured, especially on the outer side, and in young teeth by many small vertical grooves. The true molares each present four three-sided pyramidal cusps, but the internal angles of the two opposite cusps are continued into each other across the tooth, forming two concave transverse ridges. In the old animal these cusps and ridges disappear, and the grinding surface is worn quite flat.

In the genus *Macropus* the normal condition of the permanent teeth may be expressed as follows:—incisors $\frac{3-3}{1-1}$; canines $\frac{0-0}{0-0}$; præmolares $\frac{1-1}{1-1}$; molares $\frac{4-4}{4-4}$: = 28.

Tribe IV. POEPHAGA.

The present tribe includes the most strictly vegetable feeders; all the species have a complex sacculated stomach and a long simple cæcum.

Guided by the modifications of the teeth we pass from the Koala to the Kangaroo family (*Macropodidae*),—animals of widely different general form. The Potoroos, however, in this group, present absolutely the same dentition as the Koala, some slight modifications in the form of certain teeth excepted. The spurious molares, in their longitudinal extent, compressed form, and cutting edge, would chiefly distinguish the dentition of the Potoroo, but the Koala evidently offers the transitional structure between the Phalangiers and Potoroos in the condition of these teeth, of which one only is retained on each side of each jaw, in both *Phascolarctus* and *Hypsiprymnus*.

The dental formula of the genus *Hypsiprymnus* is: incisors $\frac{3-3}{1-1}$; canines $\frac{1-1}{0-0}$; præmolares $\frac{1-1}{1-1}$; mol. $\frac{4-4}{4-4}$: = 30.

The two anterior incisors are longer and more curved, the lateral incisors relatively smaller than in the Koala. The pulps of the anterior incisors are persistent.

The canines are larger than in the Koala; they always project from the line of the intermaxillary suture; and while the fang is lodged in the maxillary bone, the crown projects almost wholly from the intermaxillary. In the large *Hypsiprymnus ursinus* the canines are relatively smaller than in the other Potoroos, a structure which indicates the transition from the Potoroo to the Kangaroo genus. In the skeleton of this species in the Leyden Museum the canines present a longitudinal groove on the outer side.

The characteristic form of the trenchant spurious molar has just been alluded to; its maximum of development is attained in the arboreal Potoroos of New Guinea (*Hypsiprymnus ursinus*, and *Hyps. dorsocephalus*); in the latter of which its antero-posterior extent nearly equals that of the three succeeding molar teeth.

In all the Potoroos the trenchant spurious molar is sculptured, especially on the outer side, and in young teeth by many small vertical grooves. The true molares each present four three-sided pyramidal cusps, but the internal angles of the two opposite cusps are continued into each other across the tooth, forming two concave transverse ridges. In the old animal these cusps and ridges disappear, and the grinding surface is worn quite flat.

In the genus *Macropus* the normal condition of the permanent teeth may be expressed as follows:—incisors $\frac{3-3}{1-1}$; canines $\frac{0-0}{0-0}$; præmolares $\frac{1-1}{1-1}$; molares $\frac{4-4}{4-4}$: = 28.

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The main difference, as compared with *Hypsiprymnus*, lies in the absence of the upper canines; yet I have seen them present, but of very small size, and concealed by the gum, in a small species of Kangaroo (*Macropus rufiventer*, Ogilby.). This, however, is a rare exception; while the constant presence and conspicuous size of the canines will always serve to distinguish the Potoroo from the Kangaroo. But besides this, there are other differences in the form and proportions of certain teeth.

The upper incisors of the *Macropi* have their cutting margins on the same line, the anterior ones not being produced beyond that line as in the *Hypsiprymni*; the third or external incisor is also broader in the Kangaroos, and is grooved and complicated by one or two folds of the enamel continued from the outer side of the tooth obliquely forwards and inwards, into the substance of the tooth. In most species the anterior fold is represented by a simple groove; the relative size of the outer incisor, the extent and position of the posterior fold of enamel, and consequently the proportions of the part of the tooth in front or behind it, vary more or less in every species of *Macropus*: there are two folds of enamel near the anterior part of the tooth in *Macr. major*; the posterior portion is of the greatest extent, and the entire crown of the tooth is relatively broadest in this species. The middle incisor is here also complicated with a posterior notch and an external groove. These modifications of the external incisors have been pointed out in detail by M. Jourdan; and subgeneric distinctions have been subsequently based upon them; but they possess neither sufficient constancy nor physiological consequence, to justify such an application. M. Fr. Cuvier has proposed a binary division of the Kangaroos founded on the absence of permanent spurious molares and a supposed difference in the mode of succession of the permanent molares in the Kangaroos, combined with modifications of the muzzle or upper lip, and of the tail.

The dental formula which I have assigned to the genus *Macropus* is restricted by that naturalist in its application to some small species of Kangaroo, grouped together under the term *Halmaturus*, originally applied by Illiger to the Kangaroos generally. The rest of the Kangaroos, under the generic term *Macropus*, are characterized by the following dental formula:—incisors $\frac{6}{2}$; mol. $\frac{4-4}{4-4}$: = 24.

The truth, however, is, that both the *Halmaturi* and *Macropi* of Fr. Cuvier have their teeth developed in precisely the same number and manner; they only differ in the length of time during which certain of them are retained. In the great Kangaroo, for example, the per-

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manent spurious molar which succeeds the corresponding deciduous one in the vertical direction, is pushed out of place and shed by the time the last true molar has cut the gum: the succeeding true molar is soon afterwards extruded; and I have seen a skull of an old *Macropus major* in the Museum at Leyden, in which the grinders were reduced to two on each side of each jaw by this yielding of the anterior ones to the vis a tergo of their successors.

Tribe V. RHIZOPHAGA.

The characters of this tribe are taken from the stomach, which is simple in outward form, but complicated within by a large cardiac gland; and from the cæcum, which is short and wide, with a vermiform appendage.

Genus *Phascolomys*.

In its heavy shapeless proportions, large trunk, and short equably developed legs, the Wombat offers as great a contrast to the Kangaroos as does the Koala, which it most nearly resembles in its general outward form and want of tail. But in the more important characters afforded by the teeth and intestinal canal the Wombat differs more from the Koala than this does from either the Phalangiers or Kangaroos. The dental system presents the extreme degree of that degradation of the teeth intermediate between the front incisors and true molares which we have been tracing from the Opossum to the Kangaroos: not only have the functionless spurious molares and canines now totally disappeared, but also the posterior incisors of the upper jaw, which we have seen in the Potoroos to exhibit a feeble degree of development as compared with the anterior pair; these in fact are alone retained in the dentition of the present group, which possesses the fewest teeth of any Marsupial animal. The dental formula of the Wombat is thus reduced both in number and kind to that of the true *Rodentia*:

Incisors $\frac{2}{2}$; canines $\frac{0}{0}$; præmolares $\frac{1-1}{1-1}$; molares $\frac{4-4}{4-4}$: = 24.

The incisors, moreover, are true *dentes scalprarii*, with persistent pulps, but are inferior, especially in the lower jaw, in their relative length, and curvature, to those of the placental *Glires*: they present a subtriangular figure, and are traversed by a shallow groove on their inner surfaces.

The spurious molares present no trace of that compressed structure which characterizes them in the Koala and Kangaroos; but have a wide, oval, transverse section; those of the upper jaw being traversed on the inner side with a slight longitudinal groove. The true molares have double the size of the spurious ones: the superior

manent spurious molar which succeeds the corresponding deciduous one in the vertical direction, is pushed out of place and shed by the time the last true molar has cut the gum: the succeeding true molar is soon afterwards extruded; and I have seen a skull of an old *Macropus major* in the Museum at Leyden, in which the grinders were reduced to two on each side of each jaw by this yielding of the anterior ones to the vis a tergo of their successors.

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ones are also traversed by an internal longitudinal groove, but this is so deep and wide, that it divides the whole tooth into two prismatic portions, with one of the angles directed inwards. The inferior molares are in like manner divided into two trihedral portions, but the intervening groove is here external, and one of the faces of each prism is turned inwards. All the grinders are curved, and describe about a quarter of a circle; in the upper jaw the concavity of the curve is directed outwards, in the lower jaw inwards. The false and true molares like the incisors have persistent pulps, and are consequently devoid of true fangs: in which respect the Wombat differs from all other Marsupials, and resembles the extinct *Toxodon*, the dentigerous *Bruta*, and herbivorous *Rodentia*.

Although none of the *Marsupialia* possess teeth composed of an intermixture of layers of ivory, cement and enamel through the body of the crown; yet the layer of cement which covers the enameled crown is thickest in the vegetable-feeding Marsupials, and is remarkably distinct in the Wombat.

I may add that the Wombat deviates from the other Marsupials in the number of its ribs: as these are very constant in the rest of the order, the difference in the Wombat, which has 15 pairs, instead of 13 or 12, is the more deserving of notice. The Koala, like the Phalangiers and Kangaroos, has 13 pairs of ribs.

Professor Owen next proceeds to compare the classification of the *Marsupialia* here proposed with that of Cuvier, given in the second edition of the *Règne Animal*, and states the reasons which have led him to devise a new arrangement.

The following is a tabular view of Professor Owen's classification.

CLASSIFICATION OF THE MARSUPIALIA.

Tribes.	Families.	Genera.	Subgenera.
SARCOPHAGA.			
Three kinds of teeth; canines long in both jaws; a simple stomach; no <i>intestinum cæcum</i> .	<i>Dasyuridæ</i> .	{ Thylacinus. Dasyurus. Phascogale.	
Extinct transitional forms		{ Phascolotherium. Thylacotherium. }	Fossil.
ENTOMOPHAGA.			
Three kinds of teeth in both jaws; a simple stomach; a moderately long <i>intestinum cæcum</i> .	<i>Ambulatoria</i> .	Myrmecobitus.	
	<i>Saltatoria</i> .	{ Chæropus. Perameles.	
	<i>Scansoria</i> .	Didelphis. . . .	Cheironectes.

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Three kinds of teeth; canines long in both jaws; a simple stomach; no <i>intestinum cæcum</i> .	<i>Dasyuridæ</i> .	<div> <div>Thylacinus.</div> <div>Dasyurus.</div> <div>Phascogale.</div> </div>	
Extinct transitional forms		<div> <div>Phascolotherium.</div> <div>Thylacotherium.</div> </div>	Fossil.
ENTOMOPHAGA.			
Three kinds of teeth in both jaws; a simple stomach; a moderately long <i>intestinum cæcum</i> .	<i>Ambulatoria</i> .	Myrmecobitus.	
	<i>Saltatoria</i> .	<div> <div>Chæropus.</div> <div>Perameles.</div> </div>	
	<i>Scansoria</i> .	Didelphis.	Cheironectes.

ones are also traversed by an internal longitudinal groove, but this is so deep and wide, that it divides the whole tooth into two prismatic portions, with one of the angles directed inwards. The inferior molares are in like manner divided into two trihedral portions, but the intervening groove is here external, and one of the faces of each prism is turned inwards. All the grinders are curved, and describe about a quarter of a circle; in the upper jaw the concavity of the curve is directed outwards, in the lower jaw inwards. The false and true molares like the incisors have persistent pulps, and are consequently devoid of true fangs: in which respect the Wombat differs from all other Marsupials, and resembles the extinct *Toxodon*, the dentigerous *Bruta*, and herbivorous *Rodentia*.

Although none of the *Marsupialia* possess teeth composed of an intermixture of layers of ivory, cement and enamel through the body of the crown; yet the layer of cement which covers the enameled crown is thickest in the vegetable-feeding Marsupials, and is remarkably distinct in the Wombat.

I may add that the Wombat deviates from the other Marsupials in the number of its ribs: as these are very constant in the rest of the order, the difference in the Wombat, which has 15 pairs, instead of 13 or 12, is the more deserving of notice. The Koala, like the Phalangiers and Kangaroos, has 13 pairs of ribs.

Professor Owen next proceeds to compare the classification of the *Marsupialia* here proposed with that of Cuvier, given in the second edition of the *Règne Animal*, and states the reasons which have led him to devise a new arrangement.

The following is a tabular view of Professor Owen's classification.

CLASSIFICATION OF THE MARSUPIALIA.

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Extinct transitional forms		{ Phascolotherium. Thylacotherium. }	Fossil.
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Tribes.	Families.	Genera.	Subgenera.
CARPOPHAGA.			
Anterior incisors large and long in both jaws; canines inconstant; a simple stomach; a very long <i>intestinum cæcum</i> .	<i>Phalangistidæ</i> .	{ <i>Phalangista</i> . . . <i>Petaurus</i> .	{ <i>Cuscus</i> . <i>Pseudocheirus</i> . <i>Tapoa</i> . <i>Acrobata</i> .
	<i>Phascolarctidæ</i> .	<i>Phascolarctus</i> .	
POEPHAGA.			
Anterior incisors large and long in both jaws; canines present in the upper jaw only, or wanting. A complex stomach; a long <i>intestinum cæcum</i> .	<i>Macropodidæ</i> .	{ <i>Hypsiprymnus</i> . <i>Macropus</i> .	{ <i>Halmaturus</i> . <i>Macropus</i> .
RHIZOPHAGA.			
Two scalpriform incisors in both jaws; no canines. Stomach with a special gland; cæcum short, wide, with a vermiform appendage.	<i>Phascolomyidæ</i> .	{ <i>Phascolomys</i> . <i>Diprotodon</i> . }	Fossil.

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Section of Zoology and Botany.

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Secretaries :—Mr. E. Forbes and Mr. Patterson.

Mr. Goodsir read a paper, 'On the Follicular Stage of Dentition in the Ruminants, with some remarks on that process in the other orders of Mammalia.' The paper concluded with a recapitulation of the principal facts contained in it. 1. In all the mammalia examined (pig, rabbit, cow, and sheep, &c.), the follicular stage of dentition was observed. 2. The pulps and sacs of all the permanent teeth of the cow and sheep, with the exception of the fourth molar, are formed from the minor surfaces of cavities of reserve. 3. The depending folds of the sacs of composite teeth, are formed by the folding in of the edges of the follicle towards the base of the contained pulp, the granular body assisting in the formation of these folds. 4. The cow and sheep (and probably all the other ruminants,) possess the germs of canines and superior incisives, at an early period of their embryonic existence.—'On the preparation of Fish,' by Mr. Wilde.—'On the Ciliograda of the British Seas,' by Edward Forbes and John Goodsir.—'On some new Species of Entozoa, discovered by Dr. Bellingham,' by Mr. Wilde.—'On the Acceleration of the Growth of Wheat,' by G. Webb Hall.

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